Instructional Design Principles for Statway
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The design of the Statway (curriculum, materials, teaching routines) is intended to be an evidence-driven process. Initial design decisions should be based on hypotheses grounded in research and practitioner experience. But these initial hypotheses will be tested and refined as the Statway is implemented by community college faculty. Revisions to the Statway will be guided by evidence of students' learning, linked to faculty experiences implementing the program.

A key initial hypothesis is that statistics may provide a context for students to learn to think and reason quantitatively because it does not resemble the arithmetic and algebra classes they have taken before and are now repeating in the community college. Therefore, statistics should always be in the foreground with mathematics mainly as a subplot that reinforces and supports the learning of statistics. Mathematics should not be included if it cuts off the thinking and reasoning process. However, there may be a few instances where course learning goals demand the separate development of mathematical concepts. Regardless, the focus should be on making sense of the concepts at hand so that the correctness of a solution is not based on the answer key but on whether the solution makes sense.

The instructional focus should be on understanding of important statistical and mathematical concepts, not on memorizing of procedures. Our hypothesis is that the focus on concepts will allow students to catch up by stressing the relations of statistics skills to concepts; of statistics concepts to related statistics concepts; of statistics concepts to related mathematical concepts. This understanding of relations will make it easier for students to use thinking and reasoning to acquire new skills and concepts.

Each lesson will be designed to help students make progress towards clearly stated learning goals. The learning goals will include concepts students will be working to understand, and skills students will be working to master. In addition, related concepts will be listed that students and teachers can connect to the focal concepts and skills of the lesson. In general, it is assumed that a single lesson will not be enough to result in complete understanding of core concepts, or in mastery of important skills.

Struggling with problems – both large and small – is a core part of the instructional experience: each lesson should include one or more problems that are set up, worked on, and then discussed. Working on and discussing problems often will be followed by direct instruction of the concepts and skills that are the focus of the lesson. The goals of the problem-solving experiences are to provide a context for deep thinking about core statistical and mathematical ideas; deliberate practice of statistical and mathematical skills; opportunities to engage in the practice of statistical and mathematical discourse; and, opportunities for the instructor to see how students are thinking about the statistical ideas that are the focus of the lesson.

Target students. Our initial assumption is that students placed into elementary algebra will be able to participate in the Statway. Therefore, our lessons should not require understanding of mathematics that we know students have difficulty with (e.g., we might want to restrict data for analysis exercises to whole numbers initially, until we see evidence that students can understand decimals). We also should assume that students will have a range of English language competencies. So, we should not use excessive specialized vocabulary (unless necessary) that could make it difficult for students with limited English proficiency to participate.

Treatment of remedial mathematics. Remedial mathematics topics should never be the focus of the lesson, but instead a side activity that is connected to the main flow of the lesson. In general, remedial mathematics work should be optional, to be used by the teacher if it is determined that students need it. Thus, in the lesson plans, related mathematics will be pointed out, but activities that focus on mathematics will not be included in the lesson flow unless those skills and concepts are explicitly built into the lesson or other support is provided.

Terminology. Terminology should not be the focus of an instructional segment. Often specialized terminology is unnecessary, and the focus on terminology reinforces students' misconception that mathematics is largely a matter of memorizing arbitrary rules and procedures. If terminology is necessary – e.g., if it supports discussion of important statistical and mathematical ideas – the teacher's focus should be on using the terminology correctly as a model for students.

Technology. We must assume that students will have access to technology as they learn to understand and do statistics. Specific recommendations or requirements for technology have yet to be established and will be informed by theory about supporting learning, information gathered from the collaboratory, costs, availability, and other significant factors. We should not expect students to apply statistical procedures by hand (e.g., making scatterplots) unless we have a clear pedagogical reason for doing so.

Lesson study focus during year one. One focus of the research and development will be on the rich problems themselves and the conceptual subtasks underpinning them, as a way to facilitate students' progress towards learning goals. The lesson notes should provide guidance on how to implement each part of the rich problem. Instructors will be able observe evidence-based connections between teaching and learning, engaging in testing and refining hypotheses over time, while becoming a part of the culture of evidence.

Lessons that provide learning opportunities for teachers as well as students. Our goal is to provide lessons that support high-level implementation focused on thinking, reasoning, and understanding of important statistics and mathematics. Mathematical and statistical concepts should be made explicit through instructional

practice. While students are engaged in productive effort toward solving rich problems and learning with lessons that provide a fresh start at reasoning, instructors are provided with ways in which to sequence the approach solving rich problems.